
Review of Models, Simulations, and Games for Domestic Preparedness Training and Exercising

Volume III - a

**Prepared for:
Office for Domestic Preparedness
Department of Homeland Security**



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SUMMARY

The Department of Homeland Security Office for Domestic Preparedness (ODP), which has primary responsibility to “build and sustain the preparedness of the United States to reduce vulnerabilities, prevent, respond to, and recover from acts of terrorism¹,” contracted with [ThoughtLink, Inc.](#) to evaluate models, simulations and games (MS&G) in support of domestic preparedness (DP) training and exercising (T&E). The resulting report, [Review of Models, Simulations, and Games for Domestic Preparedness Training and Exercising Volume III](#),² details the project’s research methodology and includes reviews of nearly 100 products, along with analysis and conclusions.

ODP FY04 grant language regarding the purchase of MS&G states that grantees should consult Volume I (an interim version of product reviews, now superseded by Volume III). As of September 2004, the draft FY05 grant language will recommend consulting Volume III and also will ask that grantees justify the purchase and use of a given MS&G product/service, by a) documenting the training and/or exercise objective(s), b) documenting how the selected product/service will support those objectives, and c) providing justification for the chosen product category (potentially referring to Volume III benefits/limitations).

This report, an abbreviated version of Volume III, is intended to provide an easy reference for state and local communities. It covers:

- [Definitions of models, games and simulations](#)
- [The potential value of MS&G for Domestic Preparedness T&E](#)
- [Review of T&E product categories](#)

¹ Homeland Security Act of 2002, p.57.

² Agrait, English, Evans, Hammell, Loughran & Stahl, 2004.

In summary, ThoughtLink's review demonstrates that MS&G (used as media within a larger program that includes appropriate instructional strategies, curricula, feedback, etc.) can fulfill many of the current DP T&E requirements. The key to success is choosing an appropriate product that meets the well-defined needs of each particular group of users based upon their unique T&E requirements, logistical and cost constraints, etc.

The MS&G review established that no single group of products can be recommended that will support the requirements of all communities even though nearly all of the 100 products reviewed are suitable for some kind of T&E. To help readers make informed decisions, this report addresses key factors to consider at the product category level and provides summary evaluations of individual products on the CD-ROM accompanying this report.

Throughout this document, when examples refer to specific MS&G, the product name or abbreviation will appear in italics (see Appendix A for product names and associated abbreviations). Summary versions of their respective reviews can be found in the CD ROM containing this report. Detailed product reviews are available on the ODP web site at http://www.ojp.usdoj.gov/odp/docs/trngexercise_vol3productreviews.pdf.

WHAT ARE MS&G?

The terms models, simulations and games have multiple meanings that differ among industries and disciplines.³ This project defines models, simulations and games as follows:

A **model** is a simplified representation of physical phenomena ranging in complexity, for example, from the design of a building structure or a street map, to a set of mathematical algorithms that predict the dispersion of an airborne chemical, biological, or radiological agent using 3-D computational fluid dynamics. For example, the tool *PEGEM*, shown below, estimates chemical, biological and high explosive effects.

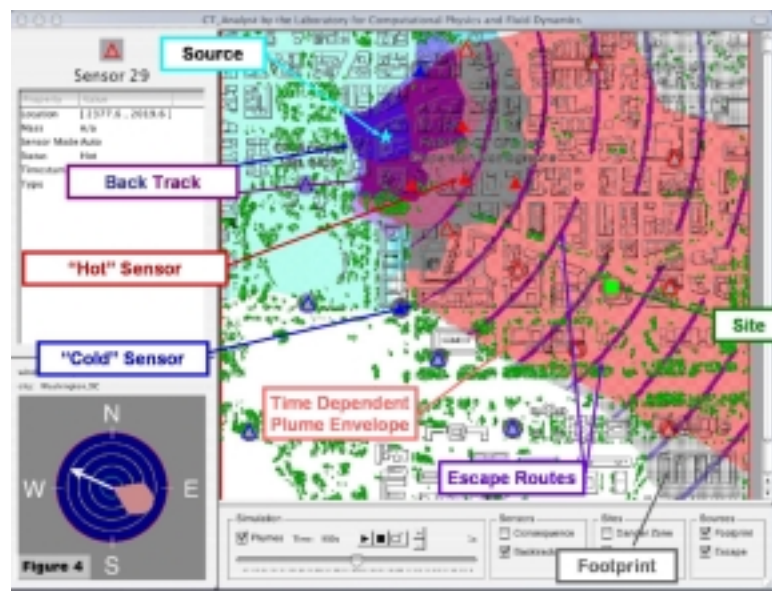


Figure 1. Sample Model - Courtesy of BAE Systems

A **simulation** is a method for implementing a model over time. For example, *Virtual Clinic*, shown below, is an interactive, three-dimensional (3-D) model of a patient presenting in a primary care setting. It is a virtual patient simulator for training clinicians in identifying and treating bioterrorism or other diseases. Simulation is also used to

³ ThoughtLink's use of these terms derives primarily from Department of Defense (DoD) accepted definitions U.S. Department of Defense, January 1998. DoD 5000.59-M "DoD Modeling and Simulation (M&S) Glossary."

describe T&E equipment that functions similarly to operational equipment. For example, *CAMSIM* is a hand-held chemical agent monitor simulator that functionally replicates the operational equipment.



Figure 2. Sample Simulation - Courtesy of RTI International

A **game** is usually a group activity or exercise in which players cooperate or compete toward a given end within the boundaries of established rules (see *Rainbow Six* below). Games often are intended to be engaging and fun.



Figure 3. Sample Game - Courtesy of Red Storm Entertainment

Generally, in this report, the term MS&G refers to combinations of products and services that incorporate modeling, simulation or gaming functionality. This document also includes reviews of a small number of information technology products that are not models, simulations or games. Such products as training videotapes, CD-ROMs, collaboration technologies and documents were selected because they could support T&E in some manner and, for the purposes of this report, will be included among “MS&G” in general.

POTENTIAL VALUE OF MS&G

Current face-to-face T&E programs cannot scale up to meet demand for domestic preparedness T&E. MS&G offers the potential to increase the reach and frequency of T&E, providing more choices that can be used more frequently by more people. The following sections detail how MS&G can benefit T&E while providing caveats as to their use.

Exercise Planning

MS&G can enhance the exercise planning process by:

- Allowing planners to “play out” scenarios and estimate parameters that would stress their systems of response and test desired objectives;
- Preparing the evaluator team to anticipate responder actions by providing detailed information about the evolving scenario and likely alternative conditions, events and actions. Thus, death and injury counts associated with multiple alternative scenario conditions (e.g., weather conditions) and responder actions (e.g., deployment of resources) could be generated rapidly;
- Demonstrating likely results of circumstances with which the planning team may have little or no experience;
- Assisting in the development of performance criteria and measures. Using simulation, response planners might ascertain what stimuli (e.g., injects) are necessary to elicit and measure response, and
- Providing a means of evaluating plans by modeling consequences based on specific city conditions and resources (e.g., performing cost estimates of response and recovery).

Realism

MS&G can approximate real conditions and enhance training via: engagement of the senses (e.g., live voice communication), psychological and physical fidelity,⁴ realistic environments (e.g., weather, terrain), portrayal of perpetrators (e.g., actions taken and equipment utilized), situational conditions and events (e.g., gas plume area and dynamic spreading), resources and actions (e.g., fire apparatus, responder teams and decisions), situation parameters (e.g., resource arrival time, disposition of resources at the scene, tracking of resources to prevent duplicate use, etc.), experiential learning (i.e., learning through experience), awareness training of the lethality of weapons of mass destruction (WMD) and real-time unfolding of events in the aftermath of a WMD attack.

Safety

MS&G allow personnel to “experience” dangerous events without exposing them or their environment to actual hazards, without consuming actual resources (e.g., personal protective equipment kits) and with little or no possibility of accidental injury to participants.

Frequency

MS&G can reduce the limitations of real-world constraints (e.g., infectious disease training need not await a “real outbreak” before being studied because such events involving myriad ailments can be modeled and medical interventions “practiced” on simulated patients). MS&G also can provide the necessary experience to enhance the decision-making process in high-stress situations even as it allows participants in many cases to participate in T&E from their offices without requiring travel to common physical sites.

T&E Conduct

MS&G can improve the quality of information available to the instructors and facilitators, the overall control of the T&E process and the quality of instruction provided participants (e.g., hot-wash feedback).

⁴ See Glossary for definitions.

Automation of Data Collection

Current T&E data collection/management is largely a manual process whose drawbacks include problems of subjectivity, data transcription errors, time-consuming and labor-intensive data processing, among others. MS&G products incorporating automated performance monitoring can improve data management. For example, the *CAMSIM* simulator automatically monitors student actions, compares them with established doctrine and records deviations from doctrine in the internal simulator log available for instructor review at any time. This information also may be combined with evaluators' observations to present a more complete response critique.

Measurement of Performance

MS&G can codify performance elements—time, decisions, resource expenditures, casualties, etc.—that will be computerized. MS&G technology (e.g., recording user-specific performance and recording information sharing among participants) can be used to assess and certify performances of participants and program alike to ensure accountability of people and platforms.

Training for Prolonged Disasters

Time inevitably is a critical factor in response and recovery efforts. To date, however, little attention has been given to the compounding effects of a WMD event on the “system of systems.” In fact, for the most part only “direct effects” are modeled and trained. Secondary (e.g., multi-day) effects on transportation systems, wastewater treatment and waste disposal, recovery logistics systems, evacuation/victim management, etc., have been inadequately incorporated into curriculum design due to time constraints, modeling complexity, and lack of prioritization. Effective models should enhance an understanding of long-term impacts, including trade-offs among alternative plans and actions. MS&G also could provide an effective context for T&E spanning extended periods of time. Although time-jumps are incorporated in human-adjudicated simulations, computer-adjudicated simulations can facilitate this process and provide added realism based on underlying models.

Breadth of Scenarios and Event Types

MS&G can address low frequency/high value type threats. Given that there have been relatively few high-risk events there is insufficient event data with which to validate domestic preparedness doctrine. T&E can be designed to allow statistical analysis of repeated experiments of low frequency/high value scenarios. Statistical analysis of performance data can then provide the basis for deriving and training best practices.

MS&G Limitations

Although MS&G present alternatives and potential enhancements in certain areas of DP T&E, they are not a panacea. As with all media offerings, consideration should be given to training requirements, instructional strategy, cost, audience readiness, logistics, availability and effectiveness, among other factors, when determining the appropriateness of MS&G for particular T&E. Potential drawbacks of MS&G include:

- Initial purchase, operating and maintenance expenses may be high;
- Some MS&G require contractor/vendor support, further increasing operating costs;
- Specific users requiring tailored MS&G characteristics (e.g., realistic and accurate modeling of unique community features and resources to achieve certain T&E objectives) also will face increased costs;
- Special hardware/software, if required, is likely to increase costs;
- Technology may be intimidating to novices and thus may require pre-training;
- Games may provide insufficient connection between learning contexts presented and the work setting, and
- Technology itself potentially may distract/detract from actual T&E goals due to either complexity or “fun factor.”

REVIEW OF TRAINING AND EXERCISING PRODUCT CATEGORIES

Products were selected primarily because they featured one or more of the following characteristics: T&E content related to WMD or closely related subjects, and MS&G thought to benefit ODP T&E. Although the selection process deliberately and methodically attempted to sample the entire spectrum of product types, it may not capture, in a statistically meaningful way, a representative sample of the entirety of MS&G products because the product selection and survey process itself imposed certain practical and theoretical limitations. Our product research findings include:

- More products exist for chemical events than for biological and radiological events;
- Expertise for radiological and nuclear devices and events is relatively limited. For example, all products reviewed on the basis of their nuclear prediction models were sourced from federal government organizations;
- While few products are oriented toward senior officials, many address individual basic awareness for first responders and team T&E;
- The vendor expertise and service required for scenario adaptation, customization to community-specific resources, geographic area and systems (information/interface) management, etc., restricts the frequency with which exercises can be conducted (e.g. the current face-to-face ODP program), and
- To increase T&E program breadth, vendor service requirements must be reduced. Further cost savings could be realized by standardizing or modularizing learning system interfaces.

Sample Use of MS&G Categories for T&E

The following is meant to advise readers as to various features offered by different MS&G products (based on ThoughtLink's product review and requirements analysis⁵). Rather than focus on each individual product's advantages and limitations, this report focuses on how different product categories best support DP T&E. This section will address product types and uses as well as the most useful criteria for product selection.

⁵ For more information on the requirement analysis and findings see [Volume III](#).

The products have been grouped into 14 categories based on attributes. Each category is presented in a summary page describing the exercises for which it is most typically used, examples of its use, and its specific advantages and limitations.

Product Type: Multi-Learner Exercise (Computer Adjudicated): products that, generally, engage users in active decision-making (versus passive learning) via computer simulation, and support determination of the probable outcomes of decisions.		
Example of T/E Use: Alexandria, VA Emergency Management used the <i>EPiCs</i> simulation in a functional exercise to simulate a terrorist attack on a Federal courthouse. <i>EPiCs</i> creates a synthetic environment for commanders to exercise decision-making skills. The simulation models response resources in order to adjudicate decisions. Trained contractor support teams input instructions from field supervisors. Commanders (the primary training audience) operate in a simulated command post in a different room, and do not interact directly with the simulation. Instead, they use real-world communication devices to issue commands and to receive situation reports from the field supervisors in the simulation room.		
	Advantages	Limitations
Who	<ul style="list-style-type: none"> -Can exercise small and large teams; -Encourages active learner participation and interaction, and -Allows for opportunity to network, build relationships, and share information. 	<ul style="list-style-type: none"> -Not suited for entry-level training, and -Not cost effective for individual T&E.
What	<ul style="list-style-type: none"> -Models WMD events; -Allows for changeability of scenarios (stimulus) and outcomes; -Scenarios can be tailored to specific municipality features; -Scenario content can be modified to incorporate new T&E content, and -Often emphasizes command, control, and communications. 	<ul style="list-style-type: none"> -Typically does not address equipment or hands-on T&E.
How	<ul style="list-style-type: none"> -Involves learners in active decision-making; -Simulation improves realism of threat modeling and learner behavior adjudication; -Scenario events playback for AAR, and -SMEs facilitate exercise and AAR. 	<ul style="list-style-type: none"> -Learners typically must travel to the exercise event, and -Use of SMEs adds to cost.
Where	<ul style="list-style-type: none"> -All participants do not need to be collocated; -Simulation typically runs on a Local Area Network, and -Adaptable to most exercise locations. 	<ul style="list-style-type: none"> -Travel expense incurred for learners who need to be physically collocated at exercise, and -Security and technical issues typically prevent operation over the Internet.
When	<ul style="list-style-type: none"> -AAR materials potentially may be distributed for individual learning apart from the exercise, and -Simulation prevents need to pre-empt use of public infrastructure and resources. 	<ul style="list-style-type: none"> -Concurrent participation requires learner schedule coordination; -Single events, and -Often last for 1 or several days, requiring coverage for participant normal duties.
Surveyed Products: <i>EPI, JANS, JCAT, JTLS, SEAS, SPCM</i>		

Product Type: Multi-Learner Exercise (Human Adjudicated): products that tend to provide active learner decision-making but not recording of user-specific performance or remote observation.		
Example of T/E Use: Products in this category are used in seminar-style exercises that emphasize decision-making, such as TTX and functional exercises. A facilitator initiates an emergency scenario, to which participants must make decisions and direct resources to effect response. Participants collaborate with each other in groups that may be F2F (e.g., <i>MLD</i>) or completely distributed (e.g., <i>SLRY</i>) or a mix of both (e.g., <i>NSM</i>). By their nature, these products rely heavily on SMEs for scenario design, post-exercise feedback, and especially for adjudication of outcomes and determining scenario event sequencing and probabilities (unlike Computer Adjudicated Exercises, in which computer programs primarily perform this function).		
	Advantages	Limitations
Who	<ul style="list-style-type: none"> -Suited for exercising decision-makers (planning and management level) and government officials, and -Allows for opportunity to network, build relationships, and share information. 	<ul style="list-style-type: none"> -Not suited for entry-level training, and -Not cost-effective for training or exercising individuals.
What	<ul style="list-style-type: none"> -Flexible support for different WMD types; -Support for formal and informal interaction among people or groups; -Potential to simulate stress and psychological fidelity; -Focus on communication and team skills, and -Scenario content can be readily modified to incorporate new T&E content. 	<ul style="list-style-type: none"> -Typically does not address equipment or hands-on T&E, and -WMD weapons effects may not be adequately represented without computer simulation.
How	<ul style="list-style-type: none"> -Involves learners in active decision-making -SMEs provide feedback to learners; -Exercise/measure individual and team tasks; -Models and simulations improve scenario fidelity and assist learners in visualizing event, and -No specific equipment required. 	<ul style="list-style-type: none"> -Usually requires a high ratio of facilitators and SMEs to learners; -Facilitator competence and skill directly affects learner benefits; -Participant debriefing is required for AAR; -Performance evaluation may lack objectivity (qualitative and non-comparative evaluation), and -Not conducive to performance measurement testing.
Where		<ul style="list-style-type: none"> -Participants may incur travel costs to attend the same event in the same place, and -Does not support distance learning.
When		<ul style="list-style-type: none"> -Participants may incur travel costs to attend the same event at the same time.
Surveyed Products: <i>ATS, MLD, MMTE, MINV, NSN, SLRY, FORT, HRAM</i>		

Product Type: Interactive T/E System (Equipment Simulation): A simulation intended to provide the equivalent of a real or hypothesized stimulus that could occur in the synthetic environment for the purpose of training.		
Example of T/E Use: The <i>Human Patient Simulator</i> , one of the products in this category, is a sophisticated mannequin that can display a variety of symptoms to biological, chemical or radiological agents and respond to simulated medical treatments. For example, it can be used by hospitals to train administration of anesthesia, using feedback via the mannequin's reaction to anesthetics (e.g., shallow breathing, dilated pupils). This product can be used for realistic T&E of low frequency scenarios associated with WMD in a manner that cannot be achieved by actors with scenario cards, or inanimate mannequins.		
	Advantages	Limitations
Who	<ul style="list-style-type: none"> -Generally suited to first responder disciplines; -Can be used individually or in teams, and -Can be used for basic, introductory training levels. 	<ul style="list-style-type: none"> -Typically not suited to large teams or interagency T&E.
What	<ul style="list-style-type: none"> -Suitable for pre-training (prior to FSE); -Suited for WMD agent exposure T&E, and -Typically has application for concepts and skills to typical job challenges. 	<ul style="list-style-type: none"> -Typically not oriented to command, control and communications T&E.
How	<ul style="list-style-type: none"> -Hands-on learning involving equipment or mock systems; -Simulation functionality provides dynamic learning conditions (stimuli); -May provide automated data summary, and -Train-the-trainer techniques used. 	<ul style="list-style-type: none"> -Generally instructor-led T&E, limiting the potential for self-guided learning.
Where	<ul style="list-style-type: none"> -Typically portable devices can be transferred among training locations, and -Dedicated space is not necessary for the systems. 	<ul style="list-style-type: none"> -Does not support distance learning, and -Requires space of varying size, depending on T&E objectives.
When		<ul style="list-style-type: none"> -Instructor and learner schedules must coincide.
Surveyed Products: <i>CMSM, HPS</i>		

Product Type: Interactive T/E System (Virtual Simulation): This category generally refers to computer-based systems that provide interactive training using multimedia.		
Example of T/E Use: Two advantages of this product category are that T&E are typically specific to a functional role and specific to a location or emergency context. The <i>WMD Decision Analysis Center</i> (Sandia Labs) is one example. The bio-weapon version of this computer-based simulation has the learner role-play a California county or state public health officer tasked with detecting an anthrax outbreak by analyzing hospital records. The transmission of anthrax is scientifically-modeled, first as an airborne plume, and second by using a population-based disease transmission model superimposed on actual health data. Upon detecting the disease, the PHO role player must decide when and how to obtain and deliver Strategic Pharmaceutical Stockpile drugs within a geo-specific region. Relative measures of decision-making effectiveness are obtained through cumulative mortality and morbidity tallies over simulated (fast) time. The <i>WMD-DAC</i> has been used in the San Francisco bay area as a driver (inject and adjudication engine) for several county EMA functional exercises.		
	Advantages	Limitations
Who	<ul style="list-style-type: none"> -Typically supports individual T&E; -Often supports first responder disciplines (e.g., law enforcement, HAZMAT, EMA), and -Supports intermediate learner levels. 	
What	<ul style="list-style-type: none"> -Training skills for events that would otherwise be too costly or dangerous to replicate in the real world, and -Suited for improving skill levels. 	<ul style="list-style-type: none"> -Content often must be developed to customer specifications (e.g., threat scenarios, terrain/location databases).
How	<ul style="list-style-type: none"> -Computer-based multimedia interfaces provide dynamic learning environments (stimuli) using simulation; -Allows for repetition for skill improvement; -Automatic data summary (scenario capture); -Records user-specific performance; -Involves learners in active decision-making; -Replaces live hazards with virtual hazards, and -Replicates geo-specific/geo-cultural locations for T&E. 	<ul style="list-style-type: none"> -Advanced technology simulations are typically the most expensive type of T&E system.
Where	<ul style="list-style-type: none"> -Typically use COTS computer systems, and -Typically hosted on a Local Area Network, allowing for limited distributed learning. 	<ul style="list-style-type: none"> -Generally suited to dedicated fixed or mobile training facilities.
When	<ul style="list-style-type: none"> -Less schedule coordination typically required than for Multi-learner Exercises. 	<ul style="list-style-type: none"> -Scheduling involves coordinating controller and learner schedules.
Surveyed Products: <i>NBC, VER, AEAS, BSMR, CRTS, EGLD, GEC, SVZC, SVZS, SVZT, STC, TTR, WDAC, ADMT, ADM1, ADMV, FSC, PIRF, VTRA, VCLC</i>		

Product Type: Operational System (Incident Response): Characterized by automatic recording of information sharing among users. Refer to networking software or hardware that allows geographically-separated workers or learners to interact via computers connected to a Local or Wide Area Network (e.g., the Internet). Products in this category typically track information sharing by participants within the collaborative environment (e.g., chat, emails, file transfers).		
Example of T/E Use: The products in this category provide decision support and communications for managing response to emergencies. Many include a training mode that can support functional exercises. For example, <i>CRISIS</i> is a networked computer system that supports both real-world incident response and command post training modes. Teams of 10 to 25 learners can participate in T&E for a range of natural and man-made disaster scenarios using Geographic Information System maps, plume models, incident logging functions and other such tools. Response strategies can be studied and learner team performance can be measured in terms of (modeled) resources expended, frequency of communications and (modeled) damage mitigation. The simulation component allows exercises to be rerun or replayed to study alternative decisions and to assist in providing AAR.		
	Advantages	Limitations
Who	-Supports small and large teams of concurrent learners/users.	
What	-Focuses on operational response; -Trains/exercises communication and team skills; -Suited for incidental T&E (does not require development and can cover 'current' events); -Contributes to knowledge management, and -Standardization of data collection.	
How	-Dual operational and T&E use involving instructor/facilitator guidance and AAR; -Training of system use can be incorporated into job training; -Automates the capture and storage of learner/user information sharing, and -Supports distributed/collaborative decision making.	-Need for instruction/facilitation generally increases cost, and -Care must be taken to distinguish T&E practice from actual operations (including visual cues, database interlocks, etc.).
Where	-Typically installed at dedicated sites (e.g., EOCs, dispatch centers, hospitals), allowing exercise and operations to use same space, and -Site can be duty station of learners.	-Ongoing operations may preclude system use for T&E.
When	-Use of such systems can reduce travel time if learners do T&E at duty station.	-Ongoing operations may preclude system use for T&E.
Surveyed Products: <i>CRI, CMS, PIS, ADPR, ETM, OPSC, RAM, SOFR, WEOC, EM2K, FMIS, GSUT, SCRB, SERS, VIGI, WEMS</i>		

Product Type: Operational System (Virtual Collaborative Environment)		
<p>Example of T/E Use: These products allow groups of participants to work from multiple physical locations communicate with each other electronically and maintain mutual situational awareness. Communication features vary by product but typically include: text chat, email, and voice communication over a LAN or WAN. DHS, for example, is incorporating Groove peer-to-peer collaboration software into the Homeland Security Information Network for intelligence sharing among Federal and state agencies. Groove allows geographically-separated computer users to share information, revise documents collaboratively and maintain situational awareness of team activities across distributed locations. While the functionality supports routine operations, it also provides a medium through which instructors and learners can participate in remote events. This type of collaborative environment can be used to plan T&E and collaboratively develop training scenarios. It also could be used as a T&E environment by providing information and having the real-world participants discuss in a distributed environment how they would react, what plans are in place, what resources would be used, etc.</p>		
	Advantages	Limitations
Who	<ul style="list-style-type: none"> -Suited to small and large teams and multi-agency coordination tasks; -Can be used by intermediate and advanced users who have regular access to a computer, and -Could be tailored for senior-level officials who have minimal time for travel or T&E. 	<ul style="list-style-type: none"> -Software licensing often is priced on a per-user basis, providing little or no stepped scale advantages, and -Typically not appropriate for entry-level learners with limited computer skills.
What	<ul style="list-style-type: none"> -Tool for improving or maintaining situational awareness; -Provides a medium for collaborative decision making; -Suited for incidental T&E (that does not require development and can cover 'current' events); -Can potentially be used for improving exercise communications, and -Can be used as a T&E planning tool. 	<ul style="list-style-type: none"> -Content is developed and supplied by the system users.
How	<ul style="list-style-type: none"> -Real-time information-sharing across geographic areas; -Multimedia (usually Web page) based user interface, and -Automatically records learner/user information-sharing. 	
Where	<ul style="list-style-type: none"> -Geographically-distributed use; -Enables distance learning, and -Typically hosted on Local and Wide Area Networks and the Internet. 	<ul style="list-style-type: none"> -Each learner requires network access via computer.
When	<ul style="list-style-type: none"> -Provides for synchronous and/or asynchronous communications among users 	
Surveyed Products: GRV, ERUM, XYB		

Product Type: Dynamic Media (Consequence Assessment Model): computer algorithms and graphical interfaces that predict and display the probable outcomes of man-made and natural disasters within a geographic region.		
Example of T/E Use: The Asymmetric Warfare Initiative – 03 was an exercise incorporating WMD in a civil/military scenario of events involving numerous federal, military, state and local governmental and public safety organizations. Since WMD events are significantly affected by weather, meteorological expertise was required. The scenario involved Ventura County (CA) Fire Department HAZMAT response to a chlorine gas incident. Weather and plume modeling provided inputs to the exercise participants – both first responders and commanders. The <i>Hazard Prediction Assessment Capability</i> was used to generate plume predictions based on weather inputs and then displayed using CATS-JACE. This system provided a means to disseminate and display gas plume results and projected impacts on the local population to all responders in the Incident Command Post ⁶ .		
	Advantages	Limitations
Who	<ul style="list-style-type: none"> -Applies to planning and management levels of learners, and -Supports incident managers and decision makers in EMA and HAZMAT disciplines. 	
What	<ul style="list-style-type: none"> -Models WMD dispersion and effects; -Suitable for pre-training (prior to FSE), and -Suitable for changing T&E scenarios or environmental conditions. 	<ul style="list-style-type: none"> -Models are typically sensitive to initial conditions and source terms; -Real-time, local weather conditions are needed for accurate predictions, and -Few models provide uncertainty or confidence interval information.
How	<ul style="list-style-type: none"> -Can help adjudicate effects of WMD in exercises; -Can be used as classroom media by instructor/SME; -Provides dynamic, probabilistic modeling of complex events, and -Involves the user in active decision-making. 	<ul style="list-style-type: none"> -Instruction is necessary prior to operating most models, limiting use for self-guided training.
Where	<ul style="list-style-type: none"> -Can be used on most COTS computer systems, and -Some models can access weather information via Internet. 	<ul style="list-style-type: none"> -Most models operate on stand-alone computer systems, limiting use in distributed/collaborative decision-making environments.
When		
Surveyed Products: ADFR, CJJC, HPAC, HYP, MIDA, PEGM, QUIC, RAMS, S3, ALO		

⁶ Borgen, Dorn, McClung, McNitt, Dumont, & Evans, 2004.

Product Type: Dynamic Media (Planning/Presentation Tool): products that are primarily software that instructors can use to prepare or present T&E.		
Example of T/E Use: At the 2003 Firehouse Expo, Baltimore, MD, instructors John Mittendorf, LAFD (Ret.) and Paul Stein, Santa Monica FD (Ret.) led the seminar, “Developing Fireground Strategies and Tactics” using <i>Fire Studio</i> presentation software. Photos of one storey and two storey single family dwellings, brick multi-storey commercial and strip commercial properties were used as the basis for discussion of “fireground size-up,” the initial process of identifying the scope of the incident, communications, evaluating time and determining operations. In addition to being displayed over imported digital photos, simulated fire and smoke was used in an animated 3D CGI image of a two storey central hallway hotel design. Seminar attendees volunteered for the role of on-scene commander, in which they were asked to do a size-up and simulate communication to the command center. The instructors would critique the size-up and then conduct an in-depth analysis of the scene to explain tactics based on both accepted doctrine and experience.		
	Advantages	Limitations
Who	-Tools used by trainers, instructors, and exercise developers.	-Not intended for primary T&E audiences.
What	-Guides and/or assists users through scenario and AAR creation for exercises; -Suitable for changing T&E topics, and -Suited for incidental T&E (can aid in development of T&E to address ‘current’ events).	-Tools tend to be specialized for certain functions or types of presentations, and -Subject matter expertise is not provided as part of the tool.
How		
Where	-Typically operate on stand-alone computer systems, and -Tools often allow planners or trainers to tailor content to municipality.	-Typically does not allow for Internet use.
When	-Tools are used prior to T&E events, and some are used as presentation tools during events.	
Surveyed Products: <i>ERSM, FS2, BTC, ESP, JDPS, MRPL, SMFX</i>		

Product Type: <u>Dynamic Media (Self-Guided Training)</u> : media that allow the learner to conduct training unaided.		
Example of T/E Use: Products in this category provide T&E content, typically to individual learners who navigate at their own pace through the material (without an instructor involved). As an example, <i>Angel Five</i> presents a WMD scenario using video clips. The learner role-plays an FBI special agent-in-charge, and is presented with multiple-choice decisions that guide subsequent scenario events. The learner can consult reference material and 'receives' email and Faxes (within the simulated environment) that further the story line. This product develops a new version of the scenario each time it is used, based on random numbers that determine scenario events and the threat, so it can be re-used by the same learner multiple times with different events and outcomes possible. These products vary in flexibility; some have only a single right way to use them, which minimizes any added benefit from re-use by the same learner.		
	Advantages	Limitations
Who	-Individual learners.	-Does not provide opportunity for learners to network, build relationships or share information.
What	-Standardized content presented in a manner that is controlled by the learner; -Content can be distributed via low-cost mass media, and -Content can address awareness level learning.	-User cannot change content so it cannot easily be adapted to current events; -Not suitable for T&E of communication and/or team skills, and -The entirety of content cannot be responsive to individual needs.
How	-Self-paced computer-based training; -Immediate feedback, and -Minimal supervision needed.	-May have one or a few paths through the content, limiting re-use by a given learner; -May not address every level of learner, and -Limited ability to certify/validate learner performance and/or learning.
Where	-Can often be delivered via Local Area Network or Internet; -Learners do not need to travel, and -Supports distance learning.	
When	-Training can occur on a flexible schedule according to learner needs.	
Surveyed Products: <i>A5, DMS, EMS, WBA, RSTO, TEMA</i>		

Product Type: Dynamic Media (Observer Tool): These products are not used as the learner T&E interface, but transfer field data to analysis and presentation tools for After Action Review.		
Example of T/E Use: These tools close the performance “feedback loop” by facilitating the collection and transfer of exercise data for analysis, After Action Review (AAR) preparation and program management purposes. <i>PowerSTRIPES</i> , for example, is a software package that helps exercise coordinators and instructors export simulation data to Microsoft Office Suite applications for preparing AAR materials. Among the various uses of the tool, the U.S. Army and Marine Corps use it to automate the export of simulation data from ModSAF and OneSAF training simulations (e.g., munitions consumed, force attrition statistics) to Microsoft PowerPoint for AAR slide presentations.		
	Advantages	Limitations
Who	-Partial automation of exercise observer duties, and -Partial automation of AAR preparer’s duties.	-Often not cost-effective for small exercises.
What	-Used for data collection and/or analysis of F2F exercises, and -Adaptable to changing T&E scenarios or content.	-Not generally suited to freeform data, necessitating predetermined data formats.
How	-Facilitates collection of user/learner specific performance data, and -Facilitates remote observation.	-Battery power for electronic data collection devices may limit use without recharging; -Displays on data collection devices may be difficult to read under certain light conditions, and -Input systems requiring significant writing or keying reduce data capture effectiveness.
Where	-Most tools incorporate a wireless local area network (WLAN) that facilitates data transfer from handheld observer tools.	-WLAN must be installed at exercise site(s), and -To date, most observer tools do not provide for data transfer via Internet.
When	-Potentially supports real-time data collection, and -Significantly reduces time to prepare AAR material.	
Surveyed Products: <i>COR, MIND, PWRS</i>		

Product Type: Dynamic Media (Entertainment): These products are of interest not for direct use as T&E tools but as examples of how MS&G elements can be incorporated into T&E media.		
Example of T/E Use: <i>Emergency Fighters for Life</i> is a PC game intended for the commercial marketplace. This product allows users to practice tactical decision-making in responding to thirty different accident or disaster scenarios. The main challenge is in choosing how to deploy emergency vehicles and teams according to the type of incident or scenario in a timely manner. The player directs emergency responders to perform certain actions to rescue victims, perform first aid and transport them to hospital. This game is an example of a low-cost, engaging medium that holds the potential to support awareness-level learning and introductory decision-making, provided it is designed for T&E purposes.		
	Advantages	Limitations
Who	-Individual and multiple users.	
What	<ul style="list-style-type: none"> -Dynamic content presented in a manner that is controlled by the learner; -Content can be distributed via low-cost mass media; -Simulation improves realism of threat modeling and learner behavior adjudication, and -Scenario events can be played back for AAR . 	<ul style="list-style-type: none"> -Focus can be on entertainment objectives (having fun) vs. specific learning objectives; -Generally does not support exercises; -Typically not suitable for changing T&E topics; -Training may not transfer directly to job duties; -Not appropriate for incidental T&E (requires development/updates to T&E 'current' events), and -May not be suitable for T&E communication and/or team skills.
How	<ul style="list-style-type: none"> -Requires active user/learner decision making; -Involves multimedia stimuli that engage the user/learner, and -Elements of competition can motivate participants. 	<ul style="list-style-type: none"> -Cannot be customized to specific location or organizational needs; -Requires debrief, and -User/learner interfaces generally do not correspond to actual equipment.
Where	<ul style="list-style-type: none"> -Widely available for COTS computers; -Potentially network accessible, and some can be played over the Internet, and -May support distance learning. 	
When	-Individual learner scheduling is generally independent of others.	
Surveyed Products: <i>EFL, R6</i>		

Product Type: <u>Dynamic Media (Other)</u> : Multimedia products that do not fit the definition of previously defined Dynamic Media types.		
Example of T/E Use: <i>CoBRA</i> is a multi-purpose software program that can be used operationally as a field reference guide for a wide range of WMD information, wireless Internet communication medium with incident logging and other uses. In T&E, the laptop-based software can be used either as an instructional reference tool in traditional classroom, or self-delivered training, or it can assist in exercise management via Master Events Scenario List function, observer checklists and wireless data collection capabilities. <i>CoBRA</i> was used in this capacity at the 2003 Gateway Response Exercise in New Jersey.		
	Advantages	Limitations
Who	-Generally support individual learning.	
What	-Computer-based multimedia provide learner information or stimuli, and -Some tools may integrate into operational systems.	-Training content may require development to customer specifications, and -Often do not support hands-on T&E.
How	-Typically target improvement type training, and -May be used for pre-training (prior to FSE).	-Typically do not involve equipment training, and -May require instruction/facilitation in person.
Where	-Generally hosted on COTS computers, and -Some may be available over a network or the Internet.	-Support for distance learning depends on particular product.
When	-Some allow for independently scheduled learning.	-T&E may need to be coordinated between instructor(s) and learners.
Surveyed Products: <i>FRST, GF, RIFS, VCIT, BRDG, CBRA, CAMO, WSTL</i>		

Product Type: <u>Static Media (Presentations):</u> Recorded multimedia segments or videos.		
Example of T/E Use: Training videos can be used in traditional classroom presentations on a wide variety of subjects. Similarly, video or other recorded multimedia presentations can be delivered via the World-wide Web to provide distance learning to remote trainees. Microsoft PowerPoint presentations, for example, frequently are used to introduce or facilitate table top exercises.		
	Advantages	Limitations
Who	<ul style="list-style-type: none"> -Can be used by individuals and groups, and -Supports entry-level learning. 	<ul style="list-style-type: none"> -Static, passive, one-way delivery lacks interaction, and -Cannot be customized to varying audience knowledge levels.
What	<ul style="list-style-type: none"> -Provides standardized training content distributed on low-cost mass media; -Useful for pre-training (e.g., basic knowledge training before participating in drills/exercises), and -Content can be developed by user organizations. 	<ul style="list-style-type: none"> -Typically not suitable for changing T&E topics; -May not be appropriate for all training levels; -Content cannot be readily updated, and -Not suitable for Training/Exercising communication and/or team skills.
How	<ul style="list-style-type: none"> -Relatively low resource requirements and easily administered; -Does not require training in use of media (e.g., videos/DVDs), and -Can typically be delivered or converted for Web delivery. 	<ul style="list-style-type: none"> -Learner retention may be low, and -Very limited role in performance measurement.
Where	<ul style="list-style-type: none"> -Widely available for COTS display hardware (VCRs, TVs, computers), and -Generally supports distance learning. 	<ul style="list-style-type: none"> -Group use requires a space large enough to house learners concurrently.
When	<ul style="list-style-type: none"> -Media can support independent scheduling for use. 	<ul style="list-style-type: none"> -If used for broadcast, learner scheduling must be coordinated.
Surveyed Products:	EAV, LLV	

Product Type: <u>Static Media (Documents):</u> media for passive learning.		
Example of T/E Use: Documents in the form of textbooks, reference books, repair manuals, paper maps etc. are traditional media used for training in circumstances where portability is desired. These media are common to traditional classroom instruction, operational field use, equipment maintenance etc. The <i>Biological Weapons Response Template</i> can be used as an instruction aid to demonstrate to health care learners the geometric growth in mortality over time for various types of biological agents and to provide a decision support template for choosing a course of action.		
	Advantages	Limitations
Who	-Can serve as job aid for most trainees (based upon availability and portability).	-Does not allow for opportunity to network, build relationships, or share information.
What	-Standardized content delivered on low-cost mass media; -Supports pre-training (e.g., read-ahead materials before exercising); -Appropriate for reference materials; -Content can be developed by user organizations, and -May support part-task training.	-Not appropriate for incidental T&E (requires development/updates to T&E 'current' events), and -Typically not suitable for changing T&E topics.
How	-Allows for individual use; -Relatively low resource requirements (development, administration, etc.); -Can be shared in electronic form (email, Web posting); -Does not require training on use, and -Does not require electricity.	-No feedback to learners; -Does not allow for experiential and/or social learning; -Delivery is static and does not support interactive learning; -Very limited role in performance measurement, and -May not support active user decision-making.
Where	-Few restrictions on where T&E takes place; -Field use of materials, and -Support distance learning.	-Does not integrate with other elements of learning systems.
When	-No constraints on when used.	
Surveyed Products:	<i>BWRT, CSB</i>	

APPENDIX A: MS&G ABBREVIATIONS

The following table lists the 100 MS&G products reviewed during this project.

MS&G Product (* indicates not completely reviewed)	Acronym	Review Date
Abbottville Tabletop Simulation	ATS	April 2003
ADASHI First Response Automated Decision Aid System for Hazardous Incidents (ADASHI)	ADFR	October 2003
ADASHI Professional Automated Decision Aid System for Hazardous Incidents (ADASHI)	ADPR	October 2003
Advanced Disaster Management System—ADMSTM Team	ADMT	January 2004
Advanced Disaster Management System—ADMSTM-1	ADM1	January 2004
Advanced Disaster Management System—ADMSTM-VR	ADMV	January 2004
Angel Five	A5	April 2003
Areal Locations of Hazardous Atmospheres (ALOHA)	ALO	January 2004
Automated Exercise and Assessment System (AEAS)	AEAS	October 2003
Biological Weapons Response Template	BWRT	October 2003
BioSimMer	BSMR	October 2003
Bridgeworks	BRDG	January 2004
Bt Create	BTC	January 2004
Chemical & Biological Response Aid (CoBRA)	CBRA	January 2004
Chemical Agent Monitor Simulator (CAMSIM)	CMSM	January 2004
Citizen's SMART Book	CSB	January 2004
Civil Emergency Reaction and Responder Training System (CERRTS)	CRTS	October 2003
Competency Observation Recording & Evaluation (CORE)	COR	April 2003
Computer-Aided Management of Emergency Operations System (CAMEO)	CAMO	January 2004
Consequences Assessment Tool Set—Joint Assessment of Catastrophic Events (CATS-JACE)	CJJC	October 2003
CRISIS	CRI	April 2003
Crisis Management Simulator Modeling Analysis Package (CMSMAP)	CMS	April 2003
Decision Making Skills for Public Officials During a Hazardous Materials Incident	DMS	April 2003
E Team	ETM	October 2003
Eagle Defender	EGLD	October 2003
EM/2000 Emergency Management Software	EM2K	January 2004

MS&G Product (* indicates not completely reviewed)	Acronym	Review Date
Emergency-Fighters for Life	EFL	April 2003
Emergency Preparedness Incident Command Simulation (EPiCS)	EPI	April 2003
Emergency Response Synchronization Matrix	ERSM	October 2003
Emergency Response to Terrorism: Basic Concepts	ERTB	January 2004
Emergency Simulation Program (ESP)	ESP	January 2004
Employee Awareness Video	EAV	January 2004
EMS Simulator	EMS	April 2003
ERoom	ERUM	January 2004
FEMIS / EMAdvantage	FMIS	January 2004
Fire Studio 2.0	FS2	October 2003
First Responders Situational Awareness Tool (FiRST)	FRST	October 2003
Force Protection Operational Requirements Testbed (FORT)	FORT	January 2004
Full Spectrum Command	FSC	January 2004
Gaming and Multimedia Applications for Environmental Crisis Mgt. Training (GAMMA-EC)	GEC	October 2003
Groove	GRV	October 2003
Guard Force	GF	October 2003
Guardian Suite	GSUT	January 2004
Hazard Prediction and Assessment Capability (HPAC)	HPAC	October 2003
HLS RAM (Response Action Model)	HRAM	January 2004
Human Patient Simulator	HPS	April 2003
Hybrid Particle And Concentration Transport Model (HYPACT)	HYP	October 2003
JANUS (National Guard Version)	JANS	October 2003
Joint Conflict & Tactical Simulation (JCATS)	JCAT	October 2003
Joint Integrated Database Prep System (JIDPS)	JDPS	January 2004
Joint Theater Level Simulation (JTLS)	JTLS	October 2003
Learning Landscapes*		October 2003
LifeLine Videos	LLV	October 2003
Mapping Applications for Response, Planning, and Local Operation Tasks (MARPLOT)	MRPL	January 2004
Mass-Casualty Medical Training and Evaluation (MMT&E)	MMTE	October 2003
Meteorological Information and Dispersion Assessment System—Anti-Terrorism (MIDAS-AT)	MIDA	October 2003
MIND	MIND	January 2004
Minerva	MINV	October 2003
Multi-Layer Decision Simulation—School Violence	MLD	April 2003

MS&G Product (* indicates not completely reviewed)	Acronym	Review Date
National Security Network	NSN	October 2003
NBC CTS 2000	NBC	April 2003
OpsCenter	OPSC	October 2003
Planning Alternatives for Interdicting National Terrorism (PAINT)*		January 2004
PEGEM	PEGM	October 2003
Pollution Incident Simulation, Control, and Evaluation System (PISCES)	PIS	April 2003
Post-Incident Review for Emergency Command Training (PIRFECTION)	PIRF	January 2004
PowerStripes	PWRS	January 2004
Quick Urban & Industrial Complex Dispersion Modeling system (QUIC)	QUIC	October 2003
Rainbow 6	R6	April 2003
RAMSAFE	RAM	October 2003
Regional Atmospheric Modeling System (RAMS)	RAMS	October 2003
Response Information Folder System (RIFS)	RIFS	October 2003
RestOps Simulation (RBITS)	RSTO	January 2004
S3-Exercise	S3	October 2003
San Louis Rey Online Simulation Training	SLRY	October 2003
ScribeVision	SCRB	January 2004
SEAS/Homeland Security Simulation	SEAS	October 2003
Security and Emergency Response Information System (SERIS)	SERS	January 2004
SIMfX	SMFX	January 2004
SimViz 3400ICS—Custom	SVZC	October 2003
SimViz 3400ICS—Standard	SVZS	October 2003
SimViz 3400ICS—Tailored	SVZT	October 2003
Site Profiler*		January 2004
SoftRisk	SOFR	October 2003
SPECTRUM	SPCM	October 2003
STAT Care	STC	October 2003
Tennessee Emergency Management (TEMA) Weapons of Mass Destruction Computer-Based Training CD-ROM	TEMA	January 2004
TUTOR	TTR	October 2003
Vigilant	VIGI	January 2004
Virtual Cities	VCIT	October 2003
Virtual Emergency Response Training Simulation	VER	April 2003

MS&G Product (* indicates not completely reviewed)	Acronym	Review Date
Virtual Terrorism Response Academy	VTRA	January 2004
VirtualClinic	VCLC	January 2004
Weapons of Mass Destruction Decision Analysis Center (WMD-DAC)	WDAC	October 2003
WebEOC	WEOC	October 2003
WebIQ*		January 2004
WisdomTools Scenarios	WSTL	January 2004
WMD Basic Awareness Training Interactive CD	WBA	April 2003
Worldreach Emergency Management Suite	WEMS	January 2004
Xybernaut Mobile Computing Tools	XYB	January 2004

APPENDIX B: GLOSSARY

Term	Definition
Attributes	Characteristics of the instructional strategy, including qualities and quantities.
Decision support system	A software program incorporating structured decision-making processes to ensure that important decisions are made on time and are based on facts, research and analysis.
Delivery mechanisms	Mechanisms and techniques by which training is delivered, including media, products and simulations.
Discipline	Organizations and personnel actively engaged in preventing, detecting and responding to a potential WMD incident by professional background such as law enforcement, fire, emergency management and emergency medical personnel.
Distributed collaborative environment	Software that enables multiple users to electronically interact with each other from different geographical locations, either in real-time (synchronously comprising of collaboration that extends beyond a LAN) or at different times (asynchronously). Interactions can vary from real-time video teleconferencing to email to file sharing.
Evaluation	A systematic method for gathering information about the impact and effectiveness of an intervention where results are used to improve the intervention, determine whether the learning objectives have been achieved and assess its value to the organization.
Exercise scenario	The synopsis of a possible series of events used during an exercise to make it more realistic.
Facilitator	The moderator of an exercise or training.
Full scale exercise	An exercise employing a city's actual response elements: equipment, personnel and other resources are mobilized.
Functional exercise	An exercise that simulates the reality of operations in a functional area by presenting complex and realistic problems in a highly stressful environment, requiring participants to quickly generate rapid and effective responses.
Game	A competitive environment where individuals or teams of individuals play against each other or against a computer in pursuit of a goal following a set of rules.
Instructional strategy	The particular set of training methods used to achieve the desired training outcome and achieve the training objectives. Same as training strategy.
Knowledge management	The process of capturing, organizing and storing information and experiences of workers and groups within an organization and making

it available to others.

Mapping	The linking of a product to a training and exercise requirement via common attributes.
Media	A generic term for devices used to train and exercise including computer-based training courses, games, books, tutorials, video teleconferencing, Web-based instruction and MS&G.
Media characteristics	The features of training and exercising media, such as simulation characteristics, media format and context. Characteristics may also pertain to features such as cost, support staff, etc.
Model	A representation of a real-world effect (e.g., a plume model may show the direction and dispersion of a chemical plume taking into account wind direction and speed); a logical description of how a system performs.
Part-task training	Training each part of a complex set of tasks separately rather than training the integrated set of tasks simultaneously.
Physical Fidelity	The degree to which the simulation imitates the visual, auditory, spatial, kinesthetic and tactile characteristics present in the real world. ⁷
Psychological Fidelity	The degree to which the salient cues for performance are present in the model and produce the same psychological, cognitive, and effective responses as are present in the real world. ⁸
Pre-training	Training or learning that occurs prior to a training course and allows the student to prepare for subsequent training.
Requirements	Training and exercise system characteristics necessary to meet ODP's preparedness needs in the area of WMD.
Resources	Supplies associated with training/exercising, including development and conduct. May include training materials, equipment, staff, facilities, time and other factors.

⁷ Department of Defense and Canadian Forces Synthetic Environment Lexicon (draft).

⁸ Ibid.

APPENDIX C: ABBREVIATIONS AND ACRONYMS

AAR	After Action Review
CD-ROM	Compact Disc-Read Only Memory
DoD	Department of Defense
DP	Domestic Preparedness
DPC	Domestic Preparedness Community
DSS	Decision Support System
EMA	Emergency Management Agency
EMS	Emergency Medical Services
EOC	Emergency Operations Center
F2F	Face-to-Face
FD	Fire Department
FE	Functional Exercise
FSE	Full Scale Exercise
GA	Government Administrator
HazMat	Hazardous Materials
HC	Health Care
LAN	Local Area Network
LE	Law Enforcement
MS&G	Models, Simulations and Games
ODP	Office for Domestic Preparedness
PC	Personal Computer
PH	Public Health
PPE	Personal Protective Equipment
PSC	Public Safety Communications

PW	Public Works
SME	Subject Matter Expert
T&E	Training and Exercise
TTX	Table Top Exercise
WAN	Wide Area Network
WMD	Weapons of Mass Destruction

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